

Introduction to Smart Contracts and Solidity

Part 5 - The Ethereum Virtual Machine
Memory and Instruction Set

The EVM - Memory hierarchy

Data areas

- Storage
- Memory
- Stack

The EVM - Memory hierarchy

Storage

- Account-dedicated
- Persistent
- Key-value map
- Cannot enumerate storage
- High I/O price
- Priority: minimize the storage use

The EVM - Memory hierarchy

Memory

- New instance per message call
- Linear - contiguous address space
- Flexibility
- Uniform access speed
- Maximum execution speed

The EVM - Memory hierarchy

Memory

- Byte-level addressing
- Word-level (256-bit / 32 byte) reads
- Byte-level and word-level (256-bit / 32 byte) writes
- Word-level (256-bit / 32 byte) expansions with gas cost

The EVM - Memory hierarchy

Stack

- Computations are performed on a stack
- Capacity: 1024 words (256-bit / 32 byte)
- Copy approach (16 + 1 elements)
- Swap approach (16 + 1 elements)
- Other operations with topmost one or two elements
- Results stored on the stack
- More complex manipulation via storage and memory

The EVM - Instruction set

Instruction Set Architecture

- How the software controls a CPU
- Interface between hardware and software
- EVM implements the abstract model of a computer (remember virtualization)

The EVM - Instruction set

Instruction Set Architecture

- Instruction set is minimized
 - Makes the consensus safe and secure
- Instruction set operands = basic data types
- Supported operations: arithmetic, bit, logic, and comparison, jumps
 - Smart contract properties access operations